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ABSTRACT

Two studies investigated how flexible children are when asked to switch from one semantic interpretation to another. Three distinctly different standards for the adjectives "big" and "little" were examined: normative, perceptual, and functional. The first study looked at whether some standards are harder than others to represent and whether switching from one standard to another is hard. Subjects were 3-year-olds (n=72). They were shown one or two objects and asked if they were big or little, with questions framed according to the standard being investigated, either perceptual or functional. For each kind of standard, the children were also asked to switch from one standard to another, switch from one context to another using the same standard, or not switch standards. The second study investigated whether it was more difficult to switch from a normative to perceptual standard or the reverse, or whether they held the same difficulty. There were three main findings: (1) young children showed great flexibility in switching among standards; (2) performance decreased when children had to switch standards; and (3) children showed a firm preferred ordering of interpretations, with perceptual standards used most easily, then normative, and finally functional. (MSE)

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# Flexibility in Semantic Representations: Children's Ability to Switch among Different Interpretations of "Big"and "Little"

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An important property of language is that word meanings are extremely sensitive to context. For example, Lakoff (1987) argues that words like "mother" and "bachelor" find their meaning in a complex set of cognitive models that vary depending on the context. At times context calls forth the notion of biological motherhood. For example, we may say "Mary Beth Whitehead is Baby M's real mother." At other times context calls forth the notion of mother-as-nurturer, as in "The teacher mothered her students." In other words, even simple nouns and verbs rarely have a single meaning. Instead, context helps us to determine which aspect of a word is called for under particular conditions.

Adjectives also take on their meanings from context. For example, we can identify three distinctly different uses of "big" and "little." One standard is normative: an object is seen by itself and is judged as big or little compared to other objects of the same kind. For example, a hat seen by itself can be judged as big or little for a hat. The hat is compared to some stored mental standard and judged relative to that standard. A second use is perceptual: an object is compared with another object of the same type that is physically present. For example, if there are two hats of different sizes, one can be judged as big or little relative to the other. A third use is functional: an object is judged by how well it fulfills an intended function. For example, a hat can be judged as big or little for a doll, depending upon how well it covers the doll's head.

All three standards are distinct from one another. Although normative and functional standards may seem similar, they are clearly different. A person who has seen a series of "widgets" may judge a new widget as normatively "big" or "little" without knowing how it is intended to function. Similarly, a novel article of clothing that keeps falling off can be judged as functionally "big" even though it may be the only article of its kind the person has ever seen.

The three standards can conflict with one another. For example, a hat that is "little" (normative standard) might be "big" for a doll (functional standard); or a hat that is "big" for a doll (functional standard) might be "little" compared to the hat next to it (perceptual standard). In order to use the words "big" and "little" correctly, people must understand not only the different meanings but also which meaning to use in a particular context. In other words, we have to coordinate among the different standards, so that we choose just the right interpretation in a given context.

This analysis raises a critical developmental problem, since "big" and "little" are among the earliest words learned in English. Use of these terms has been reported before age 2 (Robb & Lord, 1981), and we know from past work that young children use all three standards at an early age (Ebeling & Gelman, 1988; Gelman & Ebeling, 1989; Sera & Smith, 1987).

The question addressed in this paper is how flexible children are when asked to switch from one semantic interpretation to another. Based on recent research in cognitive development, we anticipated that switching would pose difficulties for children. Flavell (1986) reports that 3-year-olds find it difficult to entertain the hypothesis that an object can be simultaneously represented in two different ways. Specifically, they have a hard time focusing on the distinction between what an object really is and what it appears to be. For example, when shown a glass of white milk through a red filter and asked what color the milk really is and what color the milk appears to be, they often give the same answer to both questions. Here we address the issue of whether similar problems arise in

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children's interpretations of simple adjectives. For example, is it hard for them to represent an object as both normatively little and functionally big?

In the first study we asked two questions: 1) Are some standards harder than others? and 2) Is switching from one standard to another hard?

Table 1. Conditions and Sample Items used in Study 1.*

NOTE: Underlined items were those that subjects were asked to judge as "big" or "little".

| | No Switch | Within-Standard Switch | Across-Standard Switch |
|---|---|---|---|
| Perceptual Conditions: | No-Switch/Percep. | Perceptual/Perceptual | Normative/Perceptual |
| TRIAL 1: | 2" skirt & 4" skirt | 3" hat & 5" hat | 3" hat |
| TRIAL 2: | 1" hat & 3" hat | 1" hat & 3" hat | 1" hat & 3" hat |
| Functional Conditions: | No-Switch/Func. | Functional/Functional | Normative/Functional |
| TRIAL 1: | 2" skirt on 14" doll | 3" hat on 14" doll | 3" hat |
| TRIAL 2: | 3" hat with 6" doll | 3" hat with 6" doll | 3" hat with 6" doll |

* 8 pairs of trials were used in every condition.

In order to address these questions, we defined two factors that were manipulated to produce six conditions. (See Table 1 for examples.) One factor was the kind of standard: perceptual (children saw two articles of clothing of the same kind--for example, two hats--and judged whether one of them was big or little compared to the other) or functional (children judged whether an article of clothing was big or little for a doll). In other words, we manipulated the standard by varying the stimulus shown with the target article: sometimes it was another article of the same kind of clothing and sometimes it was a doll. While perceptual and functional standards had not been directly compared in previous studies, perceptual standards have been demonstrated in younger children, whereas functional standards have not. We therefore predicted that perceptual standards would be easier than functional standards. By including both standards in our design we could see whether switching poses problems when the task is easy, when it is difficult, or both.

The second factor was the degree of switching. We defined three levels of switching: switching from one standard to another (e.g., judging a hat as normatively little and then as big compared to a smaller hat), switching from one perspective to another while applying a single standard (e.g., judging a hat as little compared to a bigger hat and then as big compared to a littler hat), or no switching (e.g., judging a hat as little compared to a bigger hat; judging a skirt as big compared to a smaller skirt). The task can be thought of as a series of 8 sets of judgments presented in pairs (totalling 16 judgments, 2 trials for

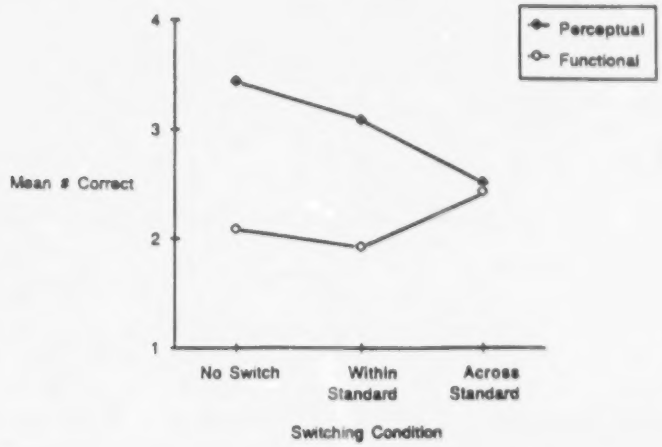
each set). No matter which condition they were in, children judged the same eight target objects (always presented second in each pair). However, the first trial (which set up the degree of switching required) and the object that appeared with the target object (which made it a perceptual or a functional judgment) were different in different conditions.

These manipulations produced six conditions altogether. Three involved perceptual judgments and three involved functional judgments. For each kind of standard, children were faced with one of three kinds of switches: switching from one standard to another, switching from one context to another but using the same standard, or no switch. Subjects were 72 3-year-olds, 12 in each of the six conditions (Ms = 3-8 in each condition). For each question, the children were shown one or two objects and were simply asked if the target object was "big" or "little." In order to help the children to use the appropriate standard, we tailored the wording to the particular kind of question being asked. For normative judgments children were asked, "Is this a big X (e.g., hat) or a little X (hat)?" For perceptual judgments children were asked, "Is this hat big or is it little?" And for functional judgments the wording was, "Is this hat big for the doll or little for the doll?"

In order to get credit for answering correctly, children had to respond correctly to both questions on a given trial. This meant that they were making the correct switch. In order to ensure that differences between groups did not simply reflect performance differences on Trial 1, we first analyzed responses to the first question of each of the 8 pairs of trials. There were no differences between the six groups on the first questions. We then performed a 2 (standard: perceptual vs. functional) x 3 (switching: across standards vs. within a standard vs. no switch) ANOVA with total correct out of 8 as the dependent variable. (See Figure 1.) Results showed that children performed much better in the perceptual conditions (M = 6.00) than in the functional conditions (M = 4.28) [F(1,66) = 13.54, p < .01]. It was easier for children to judge one shirt as bigger than another shirt, for example, than to judge it as big for a doll. This finding documents for the first time what we had suspected based on earlier work: that functional standards are more difficult for children.

Figure 1.

Study 1 Results



There was also a marginal standard x degree of switch interaction [$F(2,66) = 2.80$, $p < .07$]. In order to investigate this interaction further, we performed an ANOVA on the scores from each standard separately. This analysis showed that switching had no significant effect when children were making functional judgments, but it did disrupt children's performance in the perceptual conditions [$F(2,33) = 3.43$, $p < .05$]. In the latter conditions, children performed best when no switch was required and worst when they had to switch across standards. For example, when they judged first a normatively little shirt and then that shirt next to an even smaller shirt, performance dropped. As we predicted, shifting from one semantic interpretation to another imposes a cognitive burden on small children.

Switching appeared to have no effect on functional judgments. Performance remained consistently low in all conditions when children judged clothes for a doll. One possible reason for this could be a floor effect: functional standards could be so difficult for 3-year-olds that any effect for switching that might have been observed was washed out. On the other hand, it may be that switching had no effect in this condition because some standard other than functional is preferred and accessed first. In that case, a shift would be inherent in any functional judgment, and the switching manipulation would not have been effective. When children are faced with a functional comparison--when judging a hat for a doll, for example--their first thought may be a normative judgment. That is, they may automatically assess whether the hat is big or little for a hat. If so, then accessing the functional standard will always require a shift from a more preferred (normative or perceptual) standard to a less preferred (functional) standard.

Why does switching disrupt performance at all? One possibility is that switching in itself is difficult. For example, it may be that implicit or explicit memory for the first standard used interferes with the next judgment. In that case, it should be just as hard to switch from a perceptual to a normative standard as from a normative to a perceptual standard. In other words, changing perspective would be inherently burdensome for children. On the other hand, it might be that switching is a problem only if the child is switching from an easier to a more difficult standard. If children prefer one standard over another, there should be an asymmetry in their ability to switch. Going in one direction, switching should be hard. But going in the other direction, switching should pose no problem. The analogy that comes to mind is that it should be easier for a reader to switch from Chomsky to Agatha Christie than it would be to switch from Agatha Christie to Chomsky.

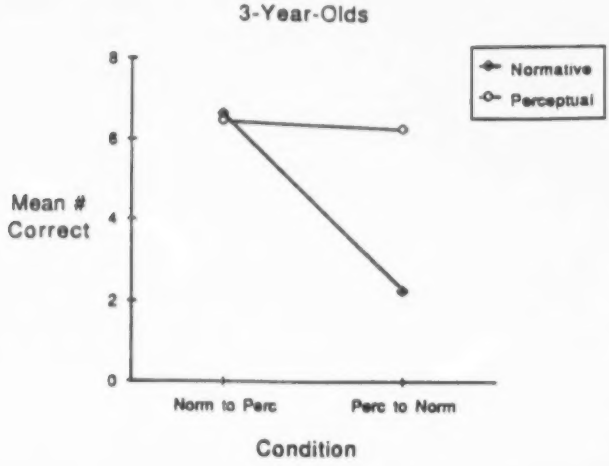
Study 2 was designed to address this issue. Is switching from a perceptual to a normative standard as difficult as switching from a normative to a perceptual standard, or are there asymmetries which suggest that one standard is preferred over another?

In order to address this question, we compared the twelve 3-year-olds in the normative-to-perceptual condition in Study 1 to 12 additional 3-year-olds in a perceptual-to-normative condition (*M*s = 3-8 in each condition). The procedure and items were the same as in Study 1. As discussed earlier, the children in the normative-to-perceptual condition first judged a single object as "big" or "little." Then they judged the same object in the context of another object of the same kind. In contrast, children in the perceptual-to-normative condition first saw the two objects and judged one of them. Then they judged the single object by itself.

Results showed a clear asymmetry in children's ability to switch. (See Figure 2.) There was a condition effect: children performed better in the normative-to-perceptual condition than in the perceptual-to-normative condition [$F(1,22) = 48.60$, $p < .0001$]. There was also a standard effect: children performed better on perceptual judgments than on normative judgments [$F(1,22) = 12.00$, $p < .01$]. Most importantly, there was an interaction between condition and standard: children in the normative-to-perceptual condition

performed well on both normative and perceptual judgments, Ms = 6.58 and 6.42 respectively; children in the perceptual-to-normative condition performed well on the perceptual judgments but poorly on the normative judgments, Ms = 6.25 and 2.25 respectively [F(1,22) = 14.18, p <.01].

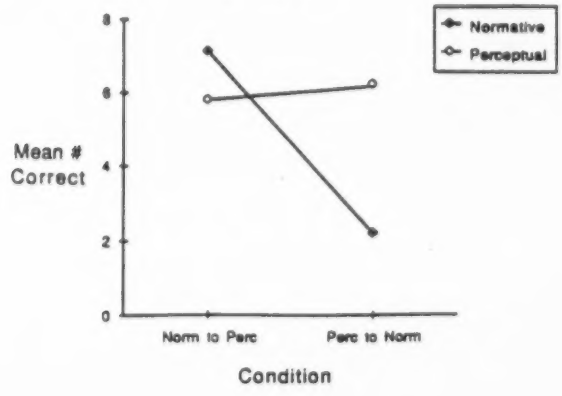
Figure 2.




What these results mean is that when switching from a perceptual to a normative standard, children ignored the normative standard. They repeated their perceptual judgment even though it was no longer appropriate. For example, they would say that a tiny 3" shoe was "big"--as if it were still beside the smaller shoe.

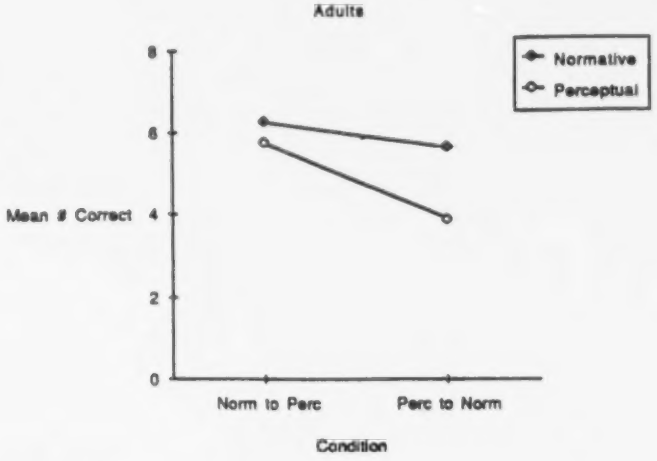
A group of nineteen 2-year-olds (Ms = 2-10 in each condition) performed essentially identically to the 3-year-olds. (See Figure 3.) There was a condition effect (children performed better in the normative-to-perceptual condition than in the perceptual-to-normative condition) [F(1,17) = 20.20, p <.0001] and an interaction between condition and standard (children in the normative-to-perceptual condition performed well on both normative and perceptual judgments, Ms = 7.10 and 5.80 respectively; children in the perceptual-to-normative condition performed well on the perceptual judgments but poorly on the normative judgments, Ms = 6.22 and 2.22 respectively) [F(1,17) = 14.49, p <.01].

Figure 3.



At this point the question arises as to whether there is anything inherent in the task that might be biasing subjects to ignore normative standards when they are shown second. In order to test this idea, we tested a group of 40 undergraduates on the same task. These adults showed the opposite bias to that of the children (see Figure 4). Like the children, they performed better in the normative-to-perceptual switch ($M = 6.00$) than in the perceptual-to-normative switch ($M = 4.77$) [$F(1,38) = 11.02$, $p < .01$]. However, they performed better on normative judgments overall ($M = 5.95$) than on perceptual judgments ($M = 4.82$) [$F(1,38) = 6.31$, $p < .05$]. Thus there is nothing inherent in the task that biases the subject toward a perceptual judgment.

Figure 4.




To summarize, there were three main findings. First, young children showed impressive flexibility in switching among standards. This was particularly striking with the 2-year-olds. These children could switch repeatedly from normative to perceptual standards, eight times over the course of a few minutes, with performance consistently well above chance. So children can switch among semantic interpretations of a given word.

But the second finding is that switching does come at a cost: when we compared switching to a control (no switch) condition, performance dropped. Even though the items were identical in the no switch and the switching conditions, performance decreased when children had to switch. This means that changing from one semantic representation to another does require effort for young children.

The third finding concerns how different interpretations of "big" and "little" are organized. Children showed a firm preferred ordering of interpretations, with perceptual standards used most easily, then normative, and finally functional. In Study 1 we saw that functional standards were hardest: the children had trouble judging the size of objects for a doll. We still do not know why this is the case, though other work we have conducted suggests that there are probably both linguistic and conceptual problems (Gelman & Ebeling, 1989). In Study 2 we saw that perceptual standards were easiest. This was shown not by initial judgments--both 2- and 3-year-olds easily made both normative and perceptual judgments on Trial 1--but by readiness to switch from one standard to another. Both 2- and 3-year-olds switched readily from normative to perceptual standards but not from perceptual to normative standards. Perceptual standards are more accessible. It is easier to determine that one of two objects is "big" or "little" than to determine that an object

seen alone is "big" or "little."

One interesting point about this ordering is that it lays to rest a very robust misconception about language development. In contrast to what many researchers have suggested (Johnston, 1985; Shaffer, 1985, p. 298), children do not prefer "absolute" interpretations of these adjectives, nor do they find relative meanings difficult to acquire. On the contrary, they appear to be the easiest of all. Children even prefer them erroneously under some conditions. They readily switch to a perceptual standard from another standard, and are reluctant to switch away from a perceptual standard. This preference for perceptual standards is perhaps not so surprising. When information is available in the environment, it is adaptive to use it; when it is not available, it is appropriate to fall back on stored knowledge. Furthermore, perceptual standards are also more basic in the sense that they are simpler (that is, based on only two objects); normative standards develop from integrating many perceptions.

This ordering raises the interesting question of how meanings are organized in memory--are some meanings just easier than others, or are these meanings organized in some way? One line of reasoning that is consistent with our findings is that some meanings are easier than others. Presumably, the easier meaning(s) would emerge earlier, and children would more readily switch from a relatively difficult meaning to an easier one. Both perceptual and normative standards depend upon a comparison of the target object with either another object of the same kind or a composite memory of many other objects of the same kind. An object could be judged as perceptually or normatively "big" or "little" by, in effect, mentally superimposing one image over another. In contrast, a functional judgment requires that one understand the function of the object, identify the relevant parts of the target and the object it is interacting with, and imagine those parts interacting to see whether the goal of the action would be achieved. In other words, the ordering observed in these studies might emerge because it is easiest to make a perceptual judgment, harder to make a normative judgment, and hardest to make a functional judgment. Certainly the fact that functional standards emerge so much later than perceptual and normative standards is consistent with the idea that they are cognitively more difficult than the other standards.

However, it is also possible that the effects we have obtained reveal something about how these meanings are organized in memory. For example, there may be an ordering such that some standards (perceptual and/or normative) are accessed more readily than others. Further research will help us to clarify this.

In sum, the study of how children organize different meanigs of big and little can be viewed as a special case of how children develop a network of meanings for any word. More broadly, this issue arises in the mental representation of homonyms and polysemy. While polysemy has been studied in adults (Small, Cottrell, & Tanenhaus, 1988), the methods used with adults (e.g., reaction time tasks with phoneme monitoring) cannot be used with children. It is our hope that the methods used here will help us begin to understand the development of semantic organization in children.

## References

Ebeling, K. S. & Gelman, S. A. (1988). Coordination of size standards by young children. Child Development, 59, 888-896.

Flavell, J. H. (1986). The development of children's knowledge about the appearance-reality distinction. American Psychologist, 41, 418-425.

Gelman, S. A. & Ebeling, K. S. (1989). Children's use of nonegocentric standards in judgments of functional size. Child Development, 60, 920-932.

Johnston, J. R. (1985). Cognitive prerequisites: The evidence from children learning English. In D. I. Slobin (Ed.), The crosslinguistic study of language acquisition (Vol. 2: Theoretical issues) (pp. 961-1004). Hillsdale, NJ: Erlbaum.

Lakoff, G. (1987). Women, fire, and dangerous things. Chicago: University of Chicago Press.

Robb, M. & Lord, E. (1981). Early uses of big and little by mothers and children. Papers and reports on Child Language Development, 20, 108-115.

Sera, M. & Smith, L. B. (1987). Big and little: "Nominal" and relative uses. Cognitive Development, 2, 89-111.

Shaffer, D. R. (1985). Developmental psychology. Monterey, CA: Brooks/Cole.

Small, S. I., Cottrell, G. W., & Tanenhaus, M. K. (1988). Lexical ambiguity resolution: Perspectives from psycholinguistics, neuropsychology, and artificial intelligence. San Mateo, CA: Morgan Kaufmann.

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